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भारतीय मानक

औद्योगिक विकिरणिकी में प्रयुक्त पारिभाषिक शब्दावली

(दूसरा पुनरीक्षण)

Indian Standard

GLOSSARY OF TERMS RELATING TO INDUSTRIAL RADIOLOGY

(Second Revision)

UDC 615·849·001·4

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1991 Price Group 9

Non-Destructive Testing Sectional Committee, MTD 21

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Non-Destructive Testing Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This Indian Standard was first published in 1963 and revised in 1981. While reviewing this Indian Standard in the light of experience gained during these years, the committee has felt to revise it by merging various sections for ease of reference and locating the terms.

This standard has been revised by taking assistance from the following publications:

ASME Code section V . . SE 686-1986 Std, Definition of terms relating to gamma and X-radiography.

Atomic Energy Regulatory Board — Safety guide SG/IN-Z :1986 Government of India.

Indian Standard

GLOSSARY OF TERMS RELATING TO INDUSTRIAL RADIOLOGY

(Second Revision)

1 SCOPE

This standard covers the definition of terms relating to industrial radiology.

2 DEFINITIONS

Absorbed Dose — The amount of energy imparted to matter by an ionizing particle or electro magnetic radiation per unit mass of irradiated material at the place of interest. It is expressed in rads.

Absorption — The removal of energy from the radiation by matter it traverses.

Absorption Coefficient — Of a uniform substance for a parallel beam of homogeneous radiation, is the ratio of the rate of decrease (in the direction of propagation) of the intensity at any point to the intensity at that point. The coefficient may refer to total, apparent, or true absorption. The rate of change of intensity may be related to length, mass per unit area, molecule, atom or electron. The absorption co-efficients are called:

Linear (μ), Mass (μp), Molecular (m_μ), Atomic (a_μ) or Electronic (e_μ) respectively. Each of these comprises one or more of the following absorption co-efficient.

Photoelectric (τ), Scattering (σ), Nuclear, and pair production (symbol not established).

Accelerator—A device that accelerates charged atomic particles to high energies. An X-ray machine or a betatron is an accelerator.

Activation — The process by which neutrons bombard stable atoms to make them radioactive.

Activity — of an amount of a radionuclide in a particular energy state at a given time, the quotient of dN by dt, where dN is the expectation value of the number of spontaneous nuclear transitions from that energy state in the time interval dt:

$$A = \frac{dN}{dt}$$

NOTE — The SI unit of activity is the reciprocal second (S^{-1}) and is given the special name Becqueral (Bq). The earlier special unit of activity, still in temporary use, was the curie (ci).

Added Filter — Filter added to the inherent filtration.

Afterglow — The persistence of light emission from an intensifying screen or fluoresent screen after an exposure. It is a form of phosphorescent radiation.

Alkali — In a developer, it is the alkaline constituent (for example, sodium carbonate) which is normally added to the developer to bring the solution to and maintain it at the desired level of chemical activity.

Alloy Heavy — A protective material containing tungsten, copper and nickel and having a density about 50 percent greater than that of lead.

Alpha Particle — A positively charged particle emitted by certain radioactive materials. It is made up of two protons and two neutrons: hence it is identical with the nucleus of a helium atom.

Alpha Radiation — It is the radiation consisting of a stream of alpha particles, which are nuclei of helium atoms emitted by radioactive atomic nuclei.

Alternating Current — Alternating current is the current that reverses its direction of flow at regular intervals. Such current is frequently referred to as ac.

Aluminiun Equivalent — The thickness of aluminium affording the same attenuation under specified conditions as the material in question.

Angstrom (Å) — A unit of length, often used to measure wave length of X-Radiation and gamma radiation equal to 10^{-8} cm.

Annular Beam — X-ray beam emerging from a special annular anode and used for X-raying circular joints.

Anode — The positively biased electrode in X-ray tube.

Anticathode — Also called target. Special metal inserted into the anode of X-ray tubes. X-ray originate from this metal surface on to which electron beam impinges.

Anti Scatter Grid — A device consisting of alternating strips of radiolucent and radio-opaque materials that allow primary radiation (useful beam) to pass and absorb some oblique secondary radiation.

Area Monitoring — The survey and measurement of types of ionizing radiation and dose levels in an area in which radiation hazards are present or suspected.

Area of Interest — The specific portion of the object image on the radiograph that is to be evaluated.

Artifact — Spurious indication on a radiograph arising, from, but not limited to, faulty manufacture, storage, handling exposure or processing.

Artificial Radioactivity — Radioactivity resulting from irradiation of atomic nuclei.

Atomic Mass Unit (AMU) — The mass of an atom. The basis of a scale of atomic weights is the oxygen atom, and the isotope of this element has arbitrarily been assigned an atomic weight of 16. Hence, the unit of the scale is 1/16 the weight of oxygen 16, or roughly the mass of the proton or neutron.

Atomic Number — The positive charge on the nucleus of the atom and equal to the number of protons in the nucleus.

Atomic Weight — of an element is approximately equivalent to the total number of protons and neutrons in the nucleus.

Attenuation — The reduction of a radiation quantity upon passage of radiation through matter, resulting from all types of interaction with that matter.

Attenuation Coefficient — of a substance for a parallel beam of specified radiation the quantity in the expression μdx for the fraction of a radiation quantity removed by attenuation in passing through a thin layer dx of that substance. It is the function of the energy of radiation. According as to whether dx is expressed in terms of length, mass per unit area, moles per unit area 'atoms per unit area' μ is called linear, mass, molar or atomic attenuation co-efficient.

Auto Radiography — The term used to describe a test in which the object being tested is radioactive or made radioactive and the radiation from the object is used to produce an image on the film.

Auto Stereogram — Any type of stereogram which can be seen three-dimensionally without the need for individual viewing devices.

Auto Transformer — A special type of transformer in which the output volatge can be easily varied. The auto transformer is thus employed to adjust the primary voltage applied to the step up transformer which produces the high voltage applied to the X-ray tube.

Average Life — The arithmatic mean value of the lives of the atoms of a radioactive nuclide. It is the reciprocal of the decay constant.

Background Radiation — The radiations of man's natural environment consisting of that which comes from cosmic rays and from the naturally radioactive elements of the earth, including that from within man's body. The term may also mean radiation extraneous to an experiment.

Back Scatter — Radiation scattered from the floor, walls, equipment and other items in the area of a radiation source. This includes secondary radiations resulting from the interaction between the primary radiations.

Back Scattering — The backward reflection of particles of radiation through angles greater than 90° to the original direction of motion.

Banking Concept — An idea or model used to facilitate the explanation of radiation exposure permitted in a life time.

Barium Clay — A moulding clay blocking material containing barium used to eliminate or reduce the amount of scattered or secondary radiation reaching the film.

Barium Concrete — Concrete containing a high proportion of barium compounds. It is used as a protective building material.

Barium Plaster — Builder's plaster containing a high proportion of barium compounds. It is used as a protective building material.

Barn — A very small unit of area used in measuring the cross-sections of atoms, nuclei, electrons and other particles. One barn is equal to 10^{-24} cm. The term is a measure of the probability that a given nuclear reaction will occur.

Barrier Protective—Barrier of attenuating materails used to reduce radiations exposure.

Beam — A directed flow of energy into space or matter.

Becquerel (Bq)—It is the unit of nuclear transformation rate. One becquerel (Bq) is equal to one transformation per second. The earlier unit of radioactivity was the curic (Cl) which was defined as $3{\cdot}7 \times 10^{10}$ disintegration per second.

Bernon Roscoe Reciprocity Law — States that the end result of a photochemical reaction is dependent only on the product of the radiation intensity (I) and the duration of the exposure (t) and is dependent on their absolute values. This implies that the resultant density of a film would depend only on the products of the radiation intensity reaching the film and the exposure time.

Betatron — A high energy electron accelerator used to produce electrons with energies of the order of 10^6 to 10^7 eV. The high energy electrons impinge on the heavy metal target to produced high energy X-rays.

Beta Particle — An electron or positron emitted from a nucleus during decay. The term beta particle is reserved for electrons and positrons.

Blocking Medium — Material of appropriate radiations capacity (for example, radiographic putty) for applying to an object, either to round off the edges of as a filling for holes, to reduced the effect of scattered radiation and to shield portions of the film which would otherwise be over-exposed.

Blocking or Masking — Surrounding specimens or covering their sections with absorptive material.

Blood Count — The determination of the number of red and white cells per cubic millimeter of peripheral blood.

Blooming — In radiographic real time imaging, an undesirable condition exhibited by some image conversion devices and television pick up tubes brought about by exceeding the allowable input brightness for the device, causing the image to go in to saturation, producing, a fuzzy image of degraded spatial resolution gray scale rendition.

Blow Hole — A hole in a casting or a weld caused by gas entrapped during solidification normally vented to the surface.

Blur — Unsharpness arising from the relative movement of the source of radiation, irradiated object and film or screen.

Body Burden — The amount of radioactive material present in the body of man or animals.

Brewstrahlung — Electromagnetic radiation emitted by charged particle when they are slowed down by electric fields in their passage through matter. Literally 'breaking radiation'.

Broad-Beam Attenuation — The attenuation of radiation by matter when a maximum amount of the scattered radiation is included in the measurement.

Build Up — An increase in radiation transmitted through material because of forward scatter.

Built Up Factor — In calculation of protective barriers the ratio of the broad beam to the narrow beam transmission at a given depth.

Byproduct Material — In atomic energy law, any radiocative material (except source or fissionable material) obtained in the process of producing or using source or fissionable material. Includes fission products and many other radioisotopes produced in nuclear reactors.

Calcium Tungstate — A fluorescent chemical compound which emits visible blueviolet light when activated by either X-ray or gamma radiation.

Callier Coefficient (Q Factor) — It is the ratio of specular to totally diffuse density. Owing to the scattering of light in photographic emulsions, the value of Q is greater than unity (usually between 1·0 and 2·0).

Capsule Gamma Ray — A capsule which contains a gamma ray source. It is usually of metal and of sufficient thickness to reduce β-ray transmission to a safe value. It is generally sealed.

Cassette — A light proof container used for holding radiographic films in position during the radiographic exposure which may or may not contain intensifying and/or filter screens.

Cathode — The negative biased electrode of the X-ray tube.

Cathode Rays — A stream of electrons emitted by a heated structure or (by a cold structure under the influence of an electric field of high intensity) and projected in a somewhat confined beam by means of an electric field or a changing magnetic field.

Cesium-137 — A radioactive isotope of the element Cs having a half life of 30 years plus or minus three years.

Characteristic Curve — The plot of optical density *versus* log of exposure or of relative exposure (also called the D-log E curve).

Characteristic X-Radiation — X-radiation consisting of discrete wave lengths which are characteristic of the emitting element. Characteristic X-radiation arising from the absorption of X or gamma radiation is sometimes called fluorescene X-radiation.

Chemical Fog — Fog arising from unwanted chemical reactions during processing.

Examples:

a) **Oxidation fog** — Fog caused by exposure of a film to air during development.

b) **Dichroic fog** — Fog arising from the deposition on the emulsion of a very thin layer of finely divided silver. When examined in white light, the deposit appears in complementary colours, for example, red by transmission and blue green by reflection.

Cine Fluorography — Cine photography of a fluoroscopic image.

Cine Radiography — The production of a succession of radiographs which can be viewed rapidly in order, thus creating an illusion of continuity.

Clearing Time — The time required for the first stage of fixing during which the whiteness of the film disappears.

Cobalt 60 — A radioisotope of the element cobalt, having a half life of 5-3 years.

Cold Cracks — appear as a straight line usually continuous throughout its length and generally exist singly. These cracks start at the surface.

Cold Shut — i) A discontinuity that appears in cast metal as a result of two streams of liquid meeting and failing to unite. ii) A portion of the surface of a forging that is separated, in part, from the main body of the metal by oxide.

Collimation — The process by which a divergent beam of energy of particles is converted into a parallel beam.

Collimator — A device usually made of lead used to surround a radiation source and so constructed as to both minimize the scattered radiation and to direct the primary or useful radiation into a more or less parallel beam on to a localised area.

Compton Effect — The glancing collision of an X-ray or gamma ray with an outermost or free electron resulting in a gain of energy for the electron.

Compton Scattering — A process in which a photon transfers a portion of its energy to an orbital electron in matter and a lower energy photon is scattered at an angle to the orginal photon path.

Condenser Ionization Chamber — name given to an ionization chamber which, having been charged to a certain potential, can be irradiated and, subsequently attached to an electrometer to measure the residual charge I whereby the dose received is ascertained.

Continuous Spectrum — The characteristic radiation pattern that exhibits energies for an unbroken series of frequencies over a wide range.

Contrast — The relative brightness of two adjacent areas in a radiograph, photographic reproduction or fluorescent screen image.

Contrast (Film) — The change in film density recorded on the film that results from a given change in radiation input. Contrast is determined from the slope of the characteristic curve.

Contrast (Image) — The contrast of image details. It depends on a number of factors, such as definition and the granular nature of the radiographic emulsion or fluorescent screen.

Contrast (Radiographic) — The measurement of difference in the film blackening resulting from various X-ray intensities transmitted by the object and recorded as density differences in the image. Thus difference in film blackening from one area to another is contrast.

Contrast Ratio — The relative amount of light emitted or reflected as between an indication and its background.

Contrast Subject — The ratio of radiation intensities passing through selected portions of a specimen.

Controlled Areas — A defined area in which the occupational exposure of personnel to radiation or to radioactive material is under the supervision of an individual in charge of radiation protection. (This implies that a controlled area is one that requires control of access, occupancy and working conditions for radiation protection purpose.)

Cosmic Rays — Ionizing rays entering the earth's atmosphere from unidentified extra-terrestrial space and resulting in the presence of photons, electrons, neutrons, protons and mesons by a collision with atoms in the atmosphere.

Crack — A material separation which has a relatively large cross-section in one direction and a small or negligible cross-section when viewed in a direction perpendicular to the first.

Crest Voltage — The maximum value of a varying voltage.

Critical Size — The established flaw size deemed to be detrimental to the serviceability of the product criteria. The acceptance or rejection levels established by design engineering as required limits to meet design performance.

Crystallography — The study of crystals and their structure.

Cumulative Dose — The total dose resulting from repeated exposure to radiation of the same region or of the whole body.

Curie — A unit of radioactive defined internationally as the quantity of any radioactive nuclide in which the number of disintegrations per second is $3{\cdot}700 \times 10^{10}$.

Curie Pie — A colloquial name applied to a portable instrument equipped with a direct reading meter used to determine the level of radiation in an area.

Curir (C) — A unit of radioactive defined internationally as the quantity of any radioactive nuclide in which the number of disintegrations per second is $3{\cdot}700 \times 10^{10}$.

Cyclotron — A particle accelerator in which the atomic particles are whirled around in a spiral between the ends of a huge magnet gaining speed with each rotation. The cyclotron is normally used for nuclear research, but the particles can be made to collide with a target to produce X-rays.

***D*/*t* Ratio** — The working distance for the X-ray tube in relation to the film-to-object distance. The working distance D and the specimen thickness t are both measured with reference to the source side of the specimen.

Decay Constant — The ratio of the rate of decay of a radioactive nuclide to the number of that nuclide present.

Defects — A discontinuity whose size, shape, orientation, location or properties make it detrimental to the useful service of the part in which it occurs or which exceeds the accept or reject criteria for this given design.

Definition (Image Definition) — The sharpness of delineation of image details in a radiograph-generally used qualitatively.

Density (Photographic)— The degree of blackening of a film is density. Film blackening of density is usually expressed in the form of the H and D curve (Huster and Driffield) which is defined as the logarithm of the reciprocal of the transparency of the film.

Density (d) = log I_0/I, where I_0 is the light intensity incident on the film and I is the light intensity transmitted.

Density Gradient — The change in density of a radiographic film at a particular film density per unit change in the logarithm of the exposure received by the film. The maximum density gradient of a film is usually called gamma.

Density (Optical) — The quantitative measure of film blackening:

$$D = \log_{10} (I_0/I)$$

where:

D = density,
I_0 = light intensity incident on the film, and
I = light intensity transmitted.

Densitometer — An instrument for measuring photographic transmission and/or reflection density.

Detail (Radiographic) — Detail is the degree of sharpness of outline of the image. If the the radiograph does not show a clear definition of object or a discontinuity in the object, it is of little value, although it may have sufficient contrast and density (same as definition).

Detector — A device which determines the presence of radiation.

Deuterium — An isotope of hydrogen having mass equal to 2 AMU (atomic mass unit).

Developing Agent — The constituent of a developer which reduces sufficient exposed silver halide grains to silver at a greater rate than unexposed or insufficiently exposed grains.

Development — The conversion of a latent image into a visible image by treatment of the emulsion with a suitable chemical solution (developer).

Dichroic Fog — Fog arising from the deposition on the emulsion of a very thin layer of finely divided silver. When examined in white light, the deposit appears in complementary colours, for example, red by transmission and blue green by reflection.

Diffraction Mottling — A diffuse diffraction pattern on a radiograph resulting from X-raying thin sections of a crystalline material. The physical process in which radiation is selectively transmitted or reflected in a given direction affected by the lattice structure of the crystal.

Direct Current (dc) — As the name implies, this term refers to an electric current flowing continuously in one direction through a conductor. Such current is frequently referred to as dc.

Discernible Image — Image capable of being recognized by sight without the aid magnification.

Discontinuity — Any interruption in the normal physical structure or configuration of a part, such as craks, laps, seams, inclusions or porosity. A discontinuity may or may not affect the usefulness of a part.

Disintegration Constant — Same as Decay Constant.

Distortion — The amount of geometrical departure of an image from the true reproduction of the object.

Double Focus Tube — An X-ray tube having a cathode provided with two filaments, only one of which is used at a time and which generally gives two different sizes of focal spot.

Dose Equivalent — A quantity which expresses the biological effect to an exposed person on a common scale for all ionising radiations. It is defined as the product of the absorbed dose and certain modified factors. It is used for radiation protection purposes only. The special unit of dose equivalent in siervert (Sv) 1 Sv = 100 rem.

Dose Rate — The radiation dose delivered per unit time and measured, for instance, rems per hour.

Dosemeter — A device that measures radiation dose, such as a film badge or ionization chamber.

Dosimetry — All the methods either of measuring directly, or of measuring indirectly and computing absorbed dose, absorbed dose rate, exposure,exposure rate, dose equivalent, etc and the science associated with these methods.

Effective Absorption Co-efficient — It is, with regard to substance, for a beam of heterogeneous radiation, the ratio of the rate of decrease (in the direction of propagation) of the intensity at any point to the intensity at that point. It may be related to any of the factors given in 'Absorption Coefficient'.

The effective absorption co-efficient is not single valued, but varies with the thickness of the absorber and the system of measurement employed.

Electromagnetic Radiation — Radiation consisting of electric and magnetic waves that travel at the speed of light. Examples:-light radiowaves gamma rays, X-rays. All can be transmitted through a vacuum.

Electron — One of the fundamental constiuents of atoms. The electron is a very small negatively charged particle with a rest mass of approximately $\frac{1}{1 \cdot 837}$ that of the H atom or $9 \cdot 107 \times 10^{-28}$ g. It has an electric charge of $4 \cdot 802 \times 10^{-10}$ statcoulomb (the E. S. U. of charge). Electron appear to be uniform in mass and charge.

Electron Radiography — Radiography by means of electrons.

Electron Volt (eV) — A unit of energy. The kinetic energy acquired by an electron when accelerated through a potential difference of IV. (One electron volt equals $1 \cdot 602 \times 10^{-12}$ ergs. One mega electron-volt (MeV) equals $1 \cdot 602 \times 10^{-6}$ ergs).

Elementary Particle — Particle presently considered to be a non-dissociable entity as distinguished from those which are considered to be assemblies, such as nuclei and ions. Examples are: photons, electrons, protons, neutrons, mesons baryons.

Emissivity — The energy emission rate usually expressed as r/c/h at 1 m. or mr/mc/h at 1 m.

Emulsion — A gelatin and silver bromide crystal mixture coated into a transparent film base.

Encapsulation — The process of sealing radioactive materials to prevent contamination.

Eoilation — Removal of the hair with the roots.

Equivalent Penetrameter Sensitivity — That thickness of penetrameter, expressed as a percentage of the section thickness radiographed, in which a designated hole would be visible under the same radiographic conditions.

Erythema — A superficial reddening of the skin.

Exogram — Radiograph of metals; another term for industrial radiography.

Exology — Radiology of metals; another term for industrial radiology.

Exposure — It is a term used generally to denote the incidence of radiation on any material, living or non-living. It is divided into the following two categories:

a) *Acute Exposure* — It is used to denote any radiation exposure which gives a high dose in a short duration.

b) *Chronic Exposure* — It is used to denote radiation exposure of long duration by fractionation or protraction.

Exposure Chart — A chart indicating the radiographic exposures appropriate for different thickness of a specified material.

Exposure Factor — The product of current and time divided by the distance squared for X-rays; and the product of curies and time divided by the distance squared for gamma rays.

Exposure Latitude — Ratio of the 'range of correct exposure; to 'intensity range of image'. It expresses the limits of under exposure and over exposure within which the intensity of image remains the same.

Exposure Meter — An instrument for predicting the exposure time required for specified radiographic conditions.

False Indication — In non-destructive inspection an indication that may be interpreted erroneously as discontinuity or defect.

Fast film — Radiographic film which has inherent graininess characteristics of a coarse nature intended to increase the relative film speed.

Field Size — Cross sectional area of the radiation beams.

Filament — The heating element of a hot cathode.

Filled Crack — A crack open to the surface, but filled with some foreign material, like oxide, grease, etc.

Filter — A layer of absorptive material that is placed in the beam of radiation for the purpose of absorbing rays of certain wavelengths and thus controlling the quality of the radiograph.

Film Badge — A package of photographic film worn like a badge by workers engaged in working with radiation sources or in a nuclear industry to measure exposure to ionizing radiation. The absorbed dose can be calculated by the degree of film darkening caused by the irradiation.

Film Base — The flexible transparent or translucent support on which an emulsion is coated.

Film Contrast — The effect of the film characteristics on radiographic contrast. A measure of this is given by the slope of the characteristic curve of the film at the relevant density. (*See* also Gradient G.)

Film Holder — A light-tight carrier for films and screens.

Film Illuminator — Equipment incorating a suitable source of illumination for viewing radiographs or other transparencies.

Film Speed — Relative exposure required to attain a specified density.

Film Ring — A film badge worn as a ring to measure the dose of radiation, usually β-radiation received by the fingers.

Fine Crack — A discontinuity in a solid material usually possessing length and depth greater than the width.

Fission — The splitting of a heavy nucleus into two roughly equal parts (which are nuclei of lighter elements) accompanied by the release of relatively large amount of energy and frequently one or more neutrons. Fission can occur spontaneously, but is usualy caused by the abosrption of gamma rays neutrons or other particles.

Fission Products — Nuclei formed by the fission of heavy elements. They are of medium atomic weight and almost all are radioative. Examples Strontium-90 and cesium-137.

Fissionable Material — Any material readily fissioned by slow neutrons. Examples : uranium-235 and plutonium-239.

Fixer — A chemical solution which dissolves unexposed silver halide from developed film emulsions.

Fixing — The chemical removal of unused silver halides from an emulsion after development. A fixing bath may be acidified (acid fixing bath) primarily to prolong its life.

Flash Radiography — The method of radiography using pulses of X-rays, where each pulse is extremely short; usually employed for moving objects.

Flaw — An imperfection in an item or material which may or may not be harmful. If harmful, it is a defect or discontinuity.

Flow Location — Process of getting the position and depth of defect.

Flaw Sensitivity — In a radiograph, the minimum detectable thickness of a specific flaw or defect, measured in the direction of the primary beam of radiation and expressed as a percentage of the total thickness of the irradiated object the latter being assumed to be of specified homogeneous material. For a flaw, the width or cross-section of the which is large campared to the unsharpness, the flaw senstivity approximates closely to the penetrameter sensitivity.

Fluorescene — The emission of electromagnetic radiation by a substance as a result of the absorption of electromagnetic or corpuscular radiation having greater unit energy than that of the fluorescent radiation. Fluorescene is charaterised by the fact that it occurs only so long as the stimulus responsible for it is maintained. The characteristic X-radiation emitted as a result of absorption of X-rays of higher frequency is a typical example of fluorescene.

Fluorescent Screen — A suitable mounted layer of material, such as barium platino-cyanide or zinc sulphide, which fluoresces in the visible region of the spectrum under the action of X-rays or other ionizing radiation. It is commonly used to give a visual image of an irradiated object.

Fluorography — The photography of a fluoroscopic image.

Fluoroscope — An X-ray tube and fluorescent screen with or without an image intensifier, and associated equipment used for fluorosocopy.

Fluoroscopy — The production of a visual image on a fluorescent screen by ionising radiation.

Flux — The intensity of neutron radiation. It is expressed as the number of neutrons passing through 1 cm^2 in 1 s.

Flux Density — This term means the number of flux lines per unit of area taken at right angles to the direction of the flux. It is a measure of magnetic field strength.

Focal Film Distance FFD or SFD —The distance between the focal spot of the X-ray tube or the radiation source and the film.

Focal spot — The area of the target on which the electron stream impinges and from which X-rays are emitted.

Fog — A darkening of the film resulting from chemical action of the developer, ageing, scattered secondary radiation, pre-exposure to radiation or exposure to visible light (*see* also Chemical Fog).

Fog Density — A general term used to denote any increase in the optical density of a processed film caused by anything other than the direct action of the image forming radiation.

Foil — Metal in sheet form less than 0·15 mm in thickness.

Foreign Materials — They may appear as isolated irregular or elongated variations of film density not corresponding to variations in thickness of material or to cavities. May be sand, slag, oxide or dross or metal of different density included in the material being examined.

Forward Scatter —Radiation scattered in approximately the direction of the primary beam.

Frilling — The loosening of an emulsion from its base, commencing at the edges. It is usually caused by prolonged immersion in a liquid of unsuitable chemical composition at too high a temperature.

Full-Wave Rectification — Rectification which allows current to flow during each half cycle of an alternating supply.

Gadolinium-153 —A radioisotope of the element gadolinium.

Gamma — The slope of the maximum straight portion of the characteristic furve.

Gamma (r) — The slope of the approximately straight portion of a characteristic curve between the toe and the shoulder. The steeper the slope the greater is the film contrast.

Gamma Emitter — An atom whose radioactive decay process is associated with the emission of gamma rays.

Gamma Infinity (rx) — The maximum gamma that can be reached by prolonged development.

Gamma Radiography (Gammagraphy) — Radiography by means of gamma rays.

Gamma-Rays — Electromagnetic radiation emitted by radioactive atomic nuclei.

Gamma-Rays Capsule — A capsule which contains a gamma-ray source. It is usually of metal and of sufficient thickness to reduce 'B' transmission to a safe value. It is generally sealed.

Gamma-Ray Source — A quantity of matter emitting gamma radiation and in a form convenient for radiology.

Gamma-Ray Source Container — A container of dense material having a wall thickness sufficient to allow safe handling for a specified limited time. For some purposes, for example, gamma radiography, it can be designed to permit exposure being made without removing the source from the container.

Gas Holes — Appear as round or elongated smooth edged, dark spots occurring individually, in clusters, or distributed throught the castings.

Gas Porosity — Represented by round or elongated dark spots corresponding to minute voids usually distributed through the entire casting.

Geiger-Muller Counter — A gas filled counter operated under such conditions that the magnitude of each pulse is independent of the number of ions initiating it.

Genetic Effects of Radiation — Effects that produce changes in those cells of organisms which give rise to egg or sperm cells and therefore affect offspring of the exposed individuals.

Geometric - Unsharpness — Unsharpness (blurring) arising from the finite size of the source of radiation. Its magnitude depends on the effective source dimensions and also on the relative distance of the source to object and object to film.

Gradient (G) — The slope of a characteristic curve at a specified density.

Graininess — A film characteristic which consists of the grouping or clumping together of the countless small silver grains into relatively large masses visible to the naked eye or with slight magnification.

Granularity — A physical measure of the inhomogeneity in a processed emulsion arising from the particular nature of the photographic image.

Grenz Rays — X-Radiation generated with X-Ray tube voltage below about 20 kV.

Grey (Gy) — A basic unit of absorbed dose of ionizing radiation in the SI system. One Gy is equal to 100 rads or one joule/Kg.

Grid Ratio — In radiography, the ratio of the depth of the opaque strips of a grid measured in the direction of the primary beam to the spacing between them.

Grid — An assembly of strips of metal, opaque to X-rays assembled edgewise and interleaved with material of low absorbation to be placed between the patient or object and the screen or film, in order to reduce the effects of scattered radiation from the patient or object.

Half Life — The time in which half the atoms in a radioactive substance disintegrate. Half lives vary from millionth part of a second to billions of years.

Half Life (Biological) — The time required for a biological system, such as a man or an animal, to eliminate, by natural processes, half the amount of a substance which has entered it.

Half Value Layer — The thickness of a material which transmits 50 percent of the radiation incident upon it.

Half Value Period (T, T1/2, 1'2) — The time in which the amount of radioactive nuclide decays to half its initial value.

Half Wave Rectification — Rectification which allows current to flow only during alternate half cycles of an alternating supply.

Half Value Thickness — The thickness of a specified substance which, when introduced into the path of a given beam of radiation, reduces its intensity to one half. It may be used as an indication of the quality of the beam or of the opacity of the substance.

Hardener — A substance (for example, chrome alum or formalin) used to harden the gelatine in the emulsion, commonly added to the fixing bath.

Hard X-Rays — A term used to express the quality of penetrating power of X-radiation. Hard X-rays are very penetrating.

Health Physics — A term in common use for the branch of radiological science dealing with protection of personnel from harmful effects of ionizing radiation.

Heavy Alloy — A protective material containing tungsten, copper, nickel and having a density about 50 percent greater than that of lead.

Heterogeneous Radiation — Radiation of a particular type having a variety of wavelength or quantum energies. In the case of X-rays, it is often referred to as the continuous spectrum or white radiation.

High Radiation Area — Means any area accessible to personnel in which there exists radiation originating in whole or in part within licensed material at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

High Tension Transformer — The transformer which supplies high anode voltage to an X-ray tube.

Hot Cathode Tube — A high vacuum X-ray tube with an incandescent cathode.

Hot Cell — A heavily shielded enclosure in which radioactive materials can be handled remotely through the use of manipulators and viewed through shielded windows so that there is no danger to personnel.

Hot Cracks — Appear as ragged dark lines of variable width and numerous branches. They have no continuity and may exist in groups. They may originate internally or at the surface.

Hot Inspection — Inspecting forgings directly off the hammer.

Hot Tear — A fracture formed in a metal during solidification.

Hyperscopic View — A stereoscopic view in which dimensions in the direction of viewing are exaggerated.

Hyposcopic View — A stereoscopic view in which dimensions in the direction of viewing are diminished.

Identification Marker — A marker usually of heavy metal used to provide a reference point or identification mark in a radiograph.

Illuminator (Film Illuminator) — Equipment incorporating a suitable source of illumination for viewing radiographs or other transparencies.

Image Amplifier—A device that enhances a radiographic image for the purpose of decreasing interpretation time or increasing image detail.

Image Contrast — The contrast of image details. It depends on a number of factors, such as definition and granular nature of the photographic emulsion or fluorescent screen.

Image Intensifier — A device used in fluoroscopy and incorporating a vacuum tube in which electrons released by X-rays from a special screen are accelerated and focussed on to a fluorescent screen, giving an image brighter than that produced by the unaided action of the X-ray beam on a fluorescent screen.

Image Quality Indicator (IQI) — A device whose image in a radiographic is used to determine radiographic quality level. It is not intended for use in judging the size nor the establishing acceptance limits of discontinuities. Also popularly known as penetrameter.

Induced Radioactivity — Radioactivity that is created by bombarding a substance with neutrons in a reactor or with charged particles produced by particle accelerators.

Inherent Filtration — The filtration of an X-ray beam by any part of the tube shield through which it should pass.

In-Motion Radiography — A method in which either the object being radiographed or the source of radiation is in motion during the exposure.

Inspection — The process of examining and checking materials and parts for possible defects or for deviation from establishment standards.

Integration Dosemeter — The name used for a dosemeter capable of registering cumulative dose, usually in multiples of a specified dose. The instrument may be arranged to operate various electrical circuits when the pre-set dose has been delivered.

Intensify Factor — The ratio of the exposure time without intensifying screens to that when screens are used, other conditions being the same.

Intensifying Screen — A layer of suitable material which when placed in close contact with a photographic emulsion adds to the photographic effects of the incident radiation. Two kinds of screens in common use are:

a) *Salt screen* — An intensifying screen consisting of a material such as calcium or cadium tungstate which fluoresces in the visible or ultravialen region of the spectrum under the action of X-rays or other ionizing radiation.

b) *Metal screen* — An intensifying screen of metal foil, usually lead, which emits secondary radiation under the action of X-rays or other ionizing radiation.

Intensity — It relates to a point in a beam of electromagnetic radiation. The amount of energy passing per unit time per unit area at the point, the area being normal to the direction of propagation.

Interlock — A device for precluding access to an area of radiation hazard either by preventing entry or by automatically removing the hazard.

Interpretation — The process of detemining the nature of an indication.

Internal Conversion X-rays — It is the characteristic X-ray produced as a result of filling up of the vacancy caused by the ejection of an orbital electron (conversion electron) of an atom due to the interaction of a gamma ray photon emitted by the nucleus of the same atom.

Inverse Square Law — The statements that in the absence of attenuation by matter, energy fluence rate, particle fluence rate, exposure rate or kerms rate of radiation from a point source is inversely proportional to the square of the distance from the source.

Ion — An atom, Molecule or fragment of a molecule possessing a net electric charge.

Ionization — The process of adding electrons to or knocking electrons from atoms or molecules, thereby creating ions, high temperature, electrical discharges and nuclear radiation can cause ionization.

Ionization Chamber — An instrument that detects ionizing radiation by observing the electrical current created when radiation ionizes gas in the chamber, making it a conductor of electricity.

Ionizing Radiation — Any radiation that directly or indirectly displaces electrons from the outer domains of atom. Examples, alpha, beta, and gamma radiation.

Ion pair — A positive ion and a negative ion or electrons having charges of the same magnitude, and formed from a neutral atom or molecule by the action of radiation or by any other agency that supplies energy.

Iridium 192 — A radioactive isotope of the element iridium which has a half life of 75 days. It is used extensively as a source of gamma radiation.

Irradiation — Exposure to radiation, as in nuclear reactors.

Isomer — One or two or more nuclides having the same atomic number and atomic weight but existing for measurable time intervals in different quantum states with different energies and radioactive properties.

Isotope — Nuclides having the same atomic number but different mass number.

***K*-Factor** — The gamma ray dose rate in rontgens per hour at a distance of one centimetre from a point source of radiation with an activity of one millicurie. Each gamma emiter has its own value of K-factor.

Kilovolt — Unit of electromotive force or potential equal to 1 000 V.

Kilovolt Peak (KVP) — The crest value of electromotive force or potential in kilovolts of a pulsating source of electrical potential.

Laminography — A special form of radiography which is used for limiting an inspection to a single plane on the material : images of the condition along the plane of interest are brought into sharp focus, while other images are smeared or blurred.

Latent Image — A condition produced and persisting in the image receptor by exposure to radiation which can be converted into a visible image by processing.

Latitude (Radiographic) — Latitude most closely aligned with contrast is commonly called the scale of the film. Latitude is the range of thickness of the material that can be transferred or recorded on the radiograph within the useful reading range of film density. A high contrast film has little latitude and conversely a low contrast film has high latitude.

L. A. W — Liquid Active Waste.

LD/50-30 Dose — *See* 'Mean Lethal Dose (MLD)'

Lead Apron — A protective shield of lead rubber. It may be a flap suspended from the fluorescent screen of an X-ray couch or stand or a garment to be worn by the operator. In the latter case it may be called a body apron.

Lead Equivalent — The thickness of metallic lead (usually expressed in millimetres) which affords the same protection as a given material under the same conditions of irradiation.

Lead Glass— Glass containing a high proportion of lead compounds. It is used as a transparent protective material.

Lead Gloves — Gloves incorporating lead rubber as a protective material.

Lead Marker — Lead letter or number used during exposure for identification in the radiographs.

Lead Protection — Protection from ionizing radiation afforded by the use of metallic lead.

Lead Rubber — Rubber containing a high proportion of lead compounds. It is used as flexible protective material.

Leak Test — A test on shield sources that the radioactive material is not being released.

Leakage Radiation — All radiation except the useful beam coming from the X-ray tube or other radiation housing.

Leucopaenia — A decrease in the number of leucocytes in the peripheral blood below about 5 000 per cubic millimeter.

Licensed-Material — Source material, special nuclear material, or by-product material, received, possessed, used or transferred under a general or a special licence issued by the Atomic Energy Commission.

Light Metal — One of the low specific gravity metals aluminium, magnesium, titanium, beryllium or their alloys.

Line Focus Principle — The process of making the angle between the anode face and the central ray such that the effective focal spot is small in relation to the actual spot size.

Linear Accelerator — A device that is used to accelerate electrons. The electron may be impigned upon a heavy metal target to produce high energy radiation.

Longitudinal Direction — The principal direction of flow in a wrought material.

Low Tension Transformer The transformer that energizes the filament of a hot cathode X-ray tube.

Macroscopic Stresses — Residual stresses which vary from tension to compression in a distance (presumably many times the grain size) which is comparable to the gauge length in ordinary strain measurements; hence detectable by X-ray or diffraction methods.

Manipulator Rod — A rigid rod used for remote handling of source pencil, normally of 2 meter length.

MAS — Milli-ampere seconds utilized to standardize a radiograph.

Mass Miniature Radiography — Fluorography using miniature photographic film.

Maximum Permissible Dose — The recommended upper limit for the dose which may be received during a specified period (usually one week) by a person who is exposed to ionizing radiation over an indefinite period. So far as is known, a normal person so exposed will suffer no harmful effect. For the whole body, the external radiation of the 1966 international value is 100 mr. per week at the body surface for X-or gamma-radiation of quantum energy less than 3 MeV.

Maximum Permissible Constant Dose Rate — The dose rate which, if constant during a specified period, would give rise to the maximum permissible dose for that period.

Mean Lethan Dose (MLD) — That single dose of whole body irradiation which will cause the death of 50 percent of those-receiving it within 30 days. This is also known as LD/50-30 dose.

Mean Life — The arithmetic mean value of the lives of the atoms of a radioactive nuclide. It is the reciprocal of the decay constant.

Metal Screen — An intensifying screen of metal foil, usually lead, which emits secondary radiation under the action of X-rays or other ionizing radiation.

MeV — One million electon volt.

Micro Shrinkage — Discontinuities that appear as dark feathery streaks or irregular patches that indicate cavities in the grain boundaries.

Microtron — An electron accelerator in which the electrons are guided in circular orbits tangential to each other (at one point) and of increasing radii under the influence of a constant magnetic field; they are accelerated at the beginning of each orbit by transversing a carrity resonator in which there is a radiofrequency electric field.

Micro Radiography — A technique used to examine very small objects or minute detail through the use of low voltage X-rays and an ultrafine film emulsion which is examined with the aid of optical enlargement.

Milliamperage — A measure of the current flowing between the cathode and the anode in an X-ray tube. The output intensity of the radiation is a function of this current.

Milliampere Second — A measure of X-ray exposure expressed as the product of the milliammeter reading and the time of exposure in seconds. The larger units 'milliampere minute' and 'milliampere-hour' are sometimes used.

Millicurie Hour — A measure of gamma ray exposure expressed as rhe product of the radioactivity of the source in millicuries and the time of exposure in hours.

Milligramme Hour — A measure of gamma ray exposure expressed as the product of the equivalent radium content of the source in milligramms and the time of exposure in hours.

Miniature Film Radiography — Fluorography using miniature photographic film.

Misruns — Discontinuities that appear as prominent darkened areas of variable dimension with a definite smooth outline.

Moderator — In neutron radiogaphy, a material used to slow down the fast neutrons. Neutrons are slowed down when they collide with atoms of light element such as hydrogen, deuterium, berryllium and carbon.

Monitoring — Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in an occupied region.

Monitoring Area — The survey and measurement of types of ionizing radiation and dose levels in an area in which radiation-hazards are present or suspected.

Mutaion — An abrupt heritable change in the genetic material.

Neighbourhood Effect — The name given to various effects arising from the diffusion of developer which has become locally exhausted or loaded with oxidation products by its action on a heavily exposed region of an emulsion. Typical examples are developer streaks and abnormal density variations near the edges of regions of high density.

Neutron — An uncharged elementary particle with a mass nearly equal to that of the proton. The isolated neutron is unstable and decays with a half life of about 13 minute into an electron proton and neutrino. Neutrons sustain the fission reaction in a nuclear reaction.

Neutron Radiography — A technique in which thermal neutrons are used as a penetrating radiation to produce the radiograph.

Non-Destructive Testing (NTD) — Testing to detect internal, surface and concealed defects or flaws in materials using techniques that do not damage or destroy the items being tested.

Non-Screen Film — X-ray film designed for use with or without metal screens, but not intended for use with salt screens. It may be of relatively high speed and coarse grain (ordinary non-screen film) or of lower speed and finer grain (fine grain-non-screen film).

Nuclear Activity — The number of disintegrations occuring in a given quantity of material per-unit time. The earlier special unit of 'Curie' is the unit of measurement. One curie is equivalent to $3{\cdot}7 \times 10^{10}$ distentagration per second.

Nucleus — The small positively charged core of an atom. It is only about 1/100 00 the diamseter of the atom, but contains nearly all the mass.

Nuclide — Any species of atom that exists for a measurable length of time. A nuclide can be distinguished by its atomic weight, atomic number, and energy state. The term is used synonymously with isotope. A radionuclide is a radioactive nuclide.

Object Film Distance — The distance between the surface of the source side of object and the plane of the recording medium.

Occupancy — Fraction of total time spent by radiation workers/members of the public in the radiation field.

Occupancy Factor — The factor by which the work load should be multiplied to correct for the degree or type of occupancy of the area in question. This factor may be based in general on the degree of occupancy averaged over a year.

Occupational Dose — Includes exposure of an individual to radiation:

a) in a restricted area; or

b) in the course of employment in which individual's duties include exposure to radiations provided that occupational dose shall not be deemed to include any exposure of an individual to radiation for the purpose of medical diagnosis or medical therapy of such individual.

Occupational Exposure — When the occupation of a person involves working with ionizing radiations, the radiation exposure received by him in carrying out his occupation is called occupational exposure.

Occupational Worker — Workers whose occupation involves working with ionizing radiation.

Opacity — Ratio of intensity of incident light to intensity of transmitted light.

Orthoscopic View — A three-dimensional view seen in normal perspective.

Over Development — Development which is greater than that required to produce the optimum results in a particular radiograph. It may arise from development for too long a time or at too high a temperature and may give rise to excessive graininess and fog.

Oxidating Fog — Fog caused by exposure of a film to air during development. (*see* also Chemical Fog.)

Pair Production — The process whereby gamma photon with energy greater than 1·02 MeV is converted directly into matter in the form of electron and position pair. Subsequent annhilation of position results in the production of two 0·51 MeV gamma photons.

Parallax Panormagram — An auto-stereogram in each vertical strip of which the image changes progressively from a leftward aspect of one edge to a rightward aspect at the other edge. When viewed through a line or lenticular grid, the aspect change within limits with lateral changes in the position of the observer. The orthoscopic viewing zones are of considerably greater width than the pseudoscopic zones.

Parallax Stereogram — An auto stereogram consisting of a composite reproduction in which vertical strips from a 'left eye' and a 'right eye' view are interdigitated and exposed to view through a screen of alternate opaque and transparent lines, or alternatively through a lenticular screen (for example, a cylindrical lenticulated screen). The orthoscopic and pseudoscopic viewing zones are of equal width.

Peak Voltage — The maximum value of a varying voltage.

Penetrameter — *See* 'Image Quality Indicator'.

Penetrameter Sensitivity — The smallest change in object thickness which can be detected in a radiograph expressed as percentage of the total thickness, the object being assumed to be of specific homogeneous material. The term applies to image details which are sufficiently large for the effects of unsharpness to be ignored, and the quantity is largely a function of radiographic contrast.

Penumbra — The shadow cast when the incident radiation is partly, but not wholly, cut off by an intervening body. The space of partial illumination between the umbra, or perfect shadow, on all sides and the full light. A marginal region of border land or partial obscurity.

Permissible Dose — Dose of ionizing radiation that, in the light of present knowledge, is not expected to cause appreciable bodily injury to a person at any time during his life time.

Personnel Dose — The dose received by personnel in the course of their work.

Personnel Monitoring — The determination of dose received by a person who may be exposed, to a radiation hazard.

Personnel Monitoring Equipment — Devices designed to be worn or carried by an individual for the purpose of measuring the dose received (for example, film badges, pocket chambers, pocket dosemeters, film rings).

Photographic Emulsion — A suspension of a photo-sensitive material, such as silver halide grains in a medium, such as gelatine.

Photographic Fog — Unwanted blackening of an emulsion arising from one or more of the following causes:

a) Development of grains which are inherently developable without exposure (inherent fog). This type of fog generally varies with the age of the emulsion, and with the conditions of storage.

b) Unintentional exposure of the emulsion to radiation or to certain gases or vapours.

c) Chemical reactions.

Photographic Intensification — Chemical treatment of a processed emulsion when under-exposed or under-developed to increase the overall contrast or density or both.

Photographic Reduction — Treatment of a processed emulsion, usually with an oxidizing agent, to less the density. There may be a change of contrast depending on the process used.

Photon — The elementary quantity of energy of electromagnetic radiation, for electromgnetic energy of frequency ν, the quantum energy is $h\nu$, where h is plancks constant.

NOTE — A photon is an elementary particle without a rest mass.

Photosensitivity — It is the property of a photographic emulsion, by virtue of which electromagnetic or corpuscular radiation may produce chemical or physical changes in the emulsion.

Plate Penetrameter — A plate of material similar to the specimen under examination, having a thickness of one or two percent of the specimen thickness and having holes of different diameters.

Pocket Dosemeter or Pocket Chamber — A small fountain pen sized ionization chamber used for monitoring radiation exposures of personnel. Before use, they are given a charge and the amount of discharge is a measure of the quantity of radiation incident.

Pores — i) Small voids in the body of a metal;

ii) Minute cavities in a compact (powder metallurgy) sometimes international;

iii) Minute perforations in an electroplated coating.

Porosity — A field of fine holes, voids or pores within a material.

Porosity Charts — Standard charts for comparing porosity size; spacing and number in a given area for a given thickness.

Positron — A fundamental particle of nature having a mass equal to that of the electron and possessing a positive charge equal to the negative charge of the electron. The mass of the positron is therfore $9 \cdot 107 \times 10^{-28}$ grams; the electrical charge carried by the positron is equal to $4 \cdot 802 \times 10^{-10}$ statcoulomb (electrostatic unit of charge).

Potter-Bucky Diaphragm — A device incorporating a grid which is kept in movement during the time of a radiographic exposure so as to eleminate grid shadows from the radiograph.

Preservative — In a developer the constituent (for example, sodium sulphite) which minimizes the exhaustion of the developer caused by serial oxidation and also serves to remove oxidation products which might otherwise retard development or produce strain.

Pressure Mark — A variation in photographic density caused by the application of local pressure to the emulsion. The pressure mark may be light or dark according to circumstances. The crescent shaped pressure mark due to severe local bending of a film is often called a crimp mark.

Primary Protective Barrier — Barrier sufficient to attenuate the useful beam to the required degree.

Primary Radiation — Radiation arising directly from the target of an X-ray tube or from a radioactive source.

Processing — A series of operations, such as developing, fixing and washing, associated with the conversion of a latent image into a stable visible image.

Protective Lead Glass — Glass containing a high proportion of lead compounds. It is used as transparent protective material.

Protective Material — Material which is used to provide protection against ionizing radiation.

Protective Source Housing — Enclosure for one or more sealed sources which limits the leakage radiation to a specified level.

Proton — A stable elementary particle having a positive charge of $1 \cdot 602\ 19 \times 10^{-19}$ C and rest mass of $1 \cdot 676\ 5 \times 10^{-27}$ kg.

Pseudo Image — The shadow cast by an irradiated object of smaller width than the source, in the region beyond the point of convergence of the umbra.

Psuedoscopic View — A reversed steroscopic view in which near objects appear to be distant and vice versa.

Q-Factor (Callier Coefficient) — It is the ratio of specular to totally diffuse density. Owing to the scattering of light in photographic emulsions, the value of Q is greater than unity (usually between 2·0 and 1·0).

Quality of Radiation — A measure of its degree of penetration.

Rad — Radiation absorbed dose. The basic unit of absorbed dose of ionizing radiation. One rad is equal to the absorption of 100 ergs of radiation energy per gram of matter.

Radiation — The propagation of energy through matter or space in the form of waves. In atomic physics, the term has been extended to include fast moving particles (alpha and beta rays, free neutrons, etc). Gamma rays and X-rays of particular interest in atomic physics are electromagnetic radiations in which energy is propagated in packets called photons.

Radiation Area — Any area accessible to personnel in which there exists radiation originating in whole or in part within licensed material at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

Radiation Burn — A burn caused by overexposure to radiant energy.

Radiation Contrast — The effect of radiation quality on contrast. A measure of this is given by the absorption coefficient of the radiation in an irradiated object.

Radiation Damage — A general term for the alternation of properties of a material arising from radiation exposure to X-rays, gamma rays, neutrons, heavy particle radiation of fission fragments in nuclear fuel material.

Radiation Danger Zone — A zone within which the maximum permissible constant doze rate or concentration is exceeded.

Radiation Hazards — A danger to health arising from exposure to ionizing radiation. It may be due to external irradiation or to radiation from radioactive material within the body.

Radiation Monitor — A device for measuring radiation in order to assess the radiation hazard.

Radiation Protection Guide — The total amounts of ionizing radiation dose over certain periods of time which may safely be permitted to exposed industrial groups. These standards, established by the Federal Radiation Council, are equivalent to what was formerly called the maximum permissible exposure.

Radiation Safety Officer — A person who possesses valid RSO's Certificate duly recognised or issued by the competent authority for this specific purpose and who further meets the qualifications specified for RSO in Para 13 (1) of schedule GSR 735.

Radiation Sickness — An illness caused by exposure to ionising radiation.

Radiation Source — An apparatus or a material emitting or capable of emitting radiation.

Radiation Survey — An investigation of factors associated with an installation or process which could give rise to a radiation hazard.

Radiation Trap — An indirect means of access to a room containing an installation which gives rise to radiation hazard. It is intended to permit freedom of access while ensuring that workers in adjacent regions cannot be exposed to more than the maximum permissible constant dose rate.

Radiation Worker — Workers whose occupation involves working with ionizing radiation.

Radioactive — Atoms which are energetically unstable and decay to a stable condition by emitting radiation are said to be radioactive.

Radioactive Contamination — Deposition of any radioactive material in any place where it is not desired, particularly where it is harmful.

Radioactive Decay (Radioactive Disintegration) — The spontaneous change of a nucleus resulting in the emission of a particle or a photon. The atom containing the original nucleus is sometimes called the parent atom and the resulting atom, the decay product or daughter atom. The term radioactive decay is also applied to the decay of neutrons and mesons.

Radioactive Material — Any material emitting radiation whether or not subject to licensing control by the Atomic Energy Commission.

Radioactive Source — Any quantity of radioactive material which is intended for use as a source of ionising radiation.

Radioactive Transformation — The spontaneous change of a nucleus resulting in the emission of a particle or a photon. The atom containing the original nucleus is sometimes called the parent atom and the resulting atom, the decay product or daughter atom. The term radioactive decay is also applied to the decay of neutrons and mesons.

Radioactive Waste — Equipment and materials (from nuclear operations) which are radioactive and for which there is no further use.

Radioactivity — Spontaneous nuclear disintegration with emission of corpuscular or electromagnetic radiations. The principal types of radioactivity are alpha disintegration, beta decay (electron emission, positron emission and electron capture) and isomeric transition.

Radioactivity Concentration Guide — The concentration of radioactivity in any environment which results in doses equal to those in radioactive protection guide. The Federal Radiation Council term replaces the maximum permissible concentration.

Radiobiology — The branch of biology which deals with the effect of radiation on living organisms.

Radiograph — A permanent, visible image on a recording medium produced by penetrating radiation passing through the material being tested.

Radiographer — A person specialising in the practical application of radiation in diagnostic radiology, radio therapy or industrial radiography.

Radiographer's Assistant — Any individual who under the personel supervision of a radiographer uses radiographic exposure devices, sealed sources or related handling tools or survey instruments in radiography.

Radiographer's Exposure Device — Any instrument containing a sealed source fastened or contained therein in which the sealed source or source sheilding thereof may be moved or otherwise changed from a shield to unshielded position for purposes of making a radiographic exposure.

Radiographic Code — A code for specifying minimum standards related to rdiographic practices.

Radiographic Contrast — It is the contrast in a radiograph, usually expressed in terms of density difference.

Radiographic Equivalence Factor — That factor by which the thickness of a material shall be multiplied in order to determine that the thickness of a standard material (often steel) will have the same absorption.

Radiographic Exposure — The subjection of an emulsion to radiation for the purpose of producing a latent image. Radiographic exposure is commonly expressed in terms of milliampere-seconds or millicurie-hours.

Radiographic Interpretation — The determination of the cause and significance of subsurface discontinuities indicated on the radiograph. The evaluation as to the acceptability or rejectability of the material is based upon the judicious application of the radiographic specifications and standards governing the material.

Radiographic Negative — A radiograph or a print in which the darker areas correspond to regions of lower radiation opacity in the object radiographed.

Radiographic Qualification Test — A procedure for determining the optimum value of d/t ratio or the proper working distance of an X-ray tube or a radioactive source.

Radiographic Quality — A qualitative term used to describe the capability of a radiograph to show flaws in the area under examination.

Radiographic Range — The maximum range of thickness of a specified homogeneous material or of radiation opacity of an object, which can be recorded satisfactorily in a single radiograph with a specified technique.

Radiographic Sensitivity — The percentage ratio of the thickness of the smallest detectable defect to the thinckness of the specimen being examined. It is a measure of the capability to detect a small discontiniuity.

Radiographic Screens — Metallic or fluorescent sheets used to intensify the radiation effect on films.

Radiographic Stereometry — The process of finding the position and dimensions of details within an object by measurements made on radiographs taken from different directions.

Radiography — The use of radiant energy in the form of neutrons, X-rays or gamma-rays for non-destructive examination of opaque objects in order to produce graphical records on sensitized films which indicate the comparative soundness of the object being tested.

3-2T Radiography — Quality level of radiography in which the finished radiograph displays a discernible image of a penetrameter hole that has a diameter equal to twice the penetrameter thickness T, which equals 3 percent of the material thickness.

Radioisotope — An unstable isotope of an element that decays or disintegrates spontaneously emitting radiation. More than 1 300 natural and artificial radioactive isotopes have been identified.

Radiological Protection — Protection of human being from injury by radiation.

Radiologist — In medical radiology, a medical specialist employing ionising radiation for the diagnosis or treatment of disease.

Radiology — The fields of application of ionising radiaton. For example medical radiology and industrial radiology.

Radium — A radioactive element with the atomic number 88. In nature, radium is found associated with uranium, which decays to radium by a series of alpha and beta emissions. Radium is used as a radiation source.

Reciprocity Failure — The departure from the reciprocity law of any given emulsion under specified conditions (for example, when salt screens are used).

Reciprocity Law — A law which states that all other conditions remaining constant, the time of exposure required to produce a given photographic density is inversely proportional to the intensity of the radiations.

Reduction Coefficient — Same as 'Effective Absorption Co-efficient'.

Reduction Factor — Dose rate without a shield divided by the dose rate with a shield interposed between a source and a point at which radiation is measured.

Reference Radiograph — A set of radiographs containing images of discontinuities. These can be used as comparison 'standards' for acceptability of materials.

Reflection Density — The common logarithm of the ratio of the brightness of a non-absorbing perfect diffuser to that of the sample, both being illuminated at an angle of 45° to the surface, the direction of measurment being normal to the surface.

Relative Biological Effectiveness (RBE) — The relative effectiveness of a given kind of ionizing radiation in producing a biologoial response as compared with 250 000 electron volt X-rays.

Replenisher — A modified form of the original developer which when added to partially exhausted developer, restores its efficiency.

Resolution — The smallest distance between recognizable images on a film or screen. It may be expressed as the number of lines per millimetre which can be seen as direct image.

Restrainer — In a developer, the constituent (for example, potassium bromide) which reduces the activity of the developing agent but enhances its preferential action by reducing the rate of development of unexposed grains to a greater extent than that of exposed grains. It thus tends to reduce the chemical fog.

Reticulation — An effect due to rupture of an emulsion coating, usually caused by rapid changes of temperature or of chemical condition of the emulsion when wet. It gives an appearance similar to the grain of leather.

Reversal — The production of a positive instead of a negative image in an emulsion or vice-versa.

Ripple-Voltage — A small periodic variation in voltage.

Rod Anode Tube — An X-ray tube in which the target is situated near the end of a long tubular anode.

Rontgen — A unit of exposure dose of ionizing radiation. It is the amount of gamma or X-ray required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimetre of dry air under standard condition.

REM (Rontgen Equivalent Man) — A unit of absorbed radiation dose in biological matter. It is equal to the absorbed dose in rads multiplied by the relative biclogical effectiveness of the radiation.

REP (Rontgen Equivalent Physical) — An absolute unit of radiation dosage, now superseded by the rad.

Rhm (Rontgens per Hour at One Metre) — A unit of effective strength of a gamma-source, under specified condition of shielding, such that at a distance of one metre in air, its gamma-rays produce a dose rate of one rontgen per nour.

R-meter — An ionization type instrument designed to measure radiation dose.

Safe Light — A special lamp used in dark rooms to provide working visibility without affecting the photosensitive emulsion of the radiographic film.

Safety-Door Switch — Micro-switch which switches on X-rays only when the X-ray room door is closed, cutting off hazardous radiation.

Safety Glass — Special glass containing a lead compound used for absorbing hazardous radiation.

Salt Screen — An intensifying screen consisting of a material, such as calcium or cadmium tungstate, which fluoresces in the visible or ultraviolet region of spectrum under the action of X-rays or other ionizing radiation.

Scatter — Secondary radiation which is emitted in all directions.

Scattering — A process that changes a particles's or photon's trajectory. Scattering is caused by collision with atoms, nuclei and other particles. If the scattered particles' energy is unchanged by the collision, elastic scattering prevails. If there is change in energy, the process is called inelastic scattering.

Scattering Angle — The angle between the directions of propagation of the primary and scattered radiations.

Scatter-Unsharpness — Unsharpness due to radiation scattered by an irradiated object, intensifying screen or fluorescent screen.

Schwarz Child Exponent — A mathematical index which may be applied to one of the variables in order to correct for the failure of the reciprocity law over a limited range.

Screening — The filtration afforded by a container of radioactive material. It is expressed quantitatively in terms of the thickness and material of the wall, or the equivalent thickness of a specified material.

Screen-Type Film — X-ray film designed for use with salt screens. It is sensitive to the fluorescent light emitted by such screens under the action of X-rays.

Sealed Source — A discrete amount of radioactive material with a light, firm and inactive enclosure which effectively prevents the loss of radioactive substance during routine use. In the case of gaseous radioisotopes (for example, emanation) a source would be regarded as sealed only if the enclosure is gas-tight.

Secondary Protective Barrier — Barrier sufficient to attenuate the scattered radiation to the required degree.

Secondary Radiation — The ionising radiation emitted by matter as a result of an interaction of the primary radiation with medium under consideration.

Segregation — Appear as variations in film density which can be explained by segregation of elements of atomic numbers different from that of the matrix.

Self-Rectification — The process by which the current is rectified in the X-ray tube itself.

Self Rectifier — Hot cathode X-ray tube which permits electronic current to flow one way only.

Sensitivity — The percentage ratio of the thickness of the smallest detectable defect to the thickness of the specimen being examined. It is a measure of the capability to detect a small discontinuity.

Sensitometry — Measurement of the properties of emulsions by examination of the change in photographic density produced under different conditions of exposure and processing.

Sequestring Agent — A constituent (for example, sodium hexametaphosphate) which is sometimes added to a developer to prevent the formulation of scum from hard water.

Shield — A layer or mass of material used to reduce the passage of ionizing radiation.

Shock Proof Tube — An X-ray tube surrounded by an earthed shield.

Shrinkage Cavity — A discrete cavity in metal caused by contraction during solidification.

Shrinkage Porosity — A localized lacy or honey combed darkened area on a film that indicates porous metal.

Sievent (SV) — A unit of absorbed radiation dose in biological matter in the SI system. One SV is equal 100 Rem or one Joule/kg.

Silver Halide — A compound of silver with one of the halogen elements, for example, silver bromide.

Site-in Charge — A person who is so designated by the employer and who possesses a valid certificate for site-in-charge duly recognised or issued by the competent authority for this specific purpose and who further meets the qualifications specified for site-in-charge as per gazette of India July 12, 1980.

Site Monitoring — Continuous or periodic measurement at local exposure rate, is complementary to personnel monitoring.

Sky-Shine — Gamma rays emerging from the top of a cell containing a strong gamma radiation source, that are scattered by air ceiling and other structural parts of the building and reach the area outside the cell wall to produce a radiation field there.

Soft Radiation — A term used to describe qualitatively the less penetrating types of X-rays, beta-rays and gamma-rays.

Soft X-rays — A term used to express the quality or penetrating power of X-radiation. Their penetrating power is relatively low.

Solarization — The diminution in density produced by exposure additional to that required to give maximum density or development. This may result in reversal.

Somatic Effect — Of radiation Biological effect, other than hereditary and teratogenic effects, which are manifest in the exposed persons.

Source — A machine or radioactive material that emits penetrating radiation.

Source Drive System — Flexible cable system to drive the source pencil to the desired positon.

Source Film Distance (SFD or also referred as film focus distance FFD) — The distance between the local spot of an X-ray tube or radiation source and the film.

Source Material — In atomic energy law, any material, except special nuclear material which contains 0·05 percent or more of uranium, thorium or any combination of the two.

Source Pencil — An assembly consisting of an encapsulated radioactive source and some times a shield plug suitably encased with provision for attachment to a camera/flexible cable.

Source Strength — Number of particles emitted by a radiation source per unit time.

Source to Film Distance (SFD) — The distance between the focal spot of an X-ray tube or radiation source and the film.

Special Nuclear Material — In atomic energy low, includes platinum, uranium 233*, or any material artificially enriched by any of these substances.

Specific Activity — Total radioactivity per gram of source material.

Specific Ionization — Number of ion pairs produced by an ionizing particle per unit pair length of medium traversed. Example: per cm of air or per micron of tissue.

Speed — It is the characteristic of an emulsion which determines the exposure required under any given set of conditions.

Stable Isotope — A nuclide that does not undergo radioactive decay.

Stationary Grid — A grid in which the opaque strips are so thin and so close together that it can remain stationary without the shadow of the strips interfering with the interpretation of the film (for example, Lysholm grid).

Step-Down Transformer — The transformer that energizes the filament of a hot cathode X-ray tube.

Step-Up Transformer — The transformer which supplies high anode voltage in X-ray tube.

Step Wedge — A block of material in the form of a series of steps used to compare the radiographic effects of X-ray under various conditions.

Step Wedge Calibration Film — A step wedge comparison film, the densities of which are traceable to a nationally portions of the specimen.

Step Wedge Penetrameter — A penetrameter of material similar to the specimen under examination having steps ranging usually from one to five percent of the specimen thickness. Each step may contain one or more drilled holes for the assessment of definition.

Stereofluoroscopy — A fluoroscopic technique which enables screen imaged to be viewed three-dimensionally.

Sterogram — Any type of steroscopic radiograph, photograph or picture.

Sterography — The production of sterograms.

Stereograticule — A scale which enables direct measurements in the direction of viewing to be made during steroscopic examination.

Stereo Radiography — The production of a pair of radiographs of an object from two different angles, in order that they may be viewed or measured steroscopically, so that the viewer sees a three dimensional image.

Stereoscopy — The three-dimensional visual effect resulting from binocular vision.

Stop Bath — An acid bath used to arrest development and to neutralize alkaline developer in an emulsion before transfer to the fixing bath.

Stripping Emulsion — A photographic emulsion for used in autoradiography which can be removed from its base and placed in contact with a specimen containing radioactive material.

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*Uranium containing more than the natural abundance of the uranium-235.

Subject Contrast — The ratio of the radiation intensities transmitted by selected portions of the specimen.

Subject Range — The range of thickness or radiation opacity of material in an object which is to be examined.

Subjective Contrast — Qualitative contrast in a radiograph or fluorescent screen reproduction as estimated visually.

Suppressor — Retifier device used for suppressing the negative half cycle.

Surface Irregularity — An image on a radiograph film that corresponds to an irregularity visible on the surface of an object being tested.

Survey — Evaluation of the radiation hazards incident to the production, use, release, disposal or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment and measurements of levels of radiation.

Survey Meter — A portable instrument which measures dose rate of exposure of radiation intensity.

Synchrotron — An accelerator in which the particles are guided by an increasing magnetic field while they are accelerated several times (in an approximately circular path) by electric fields produced by a high frequency generator.

Target — The surface of the anode of an X-Ray tube on which the electron stream impinges and from which the main beam of X-ray is admitted.

Tele Radiography — Radiography employing large source-to-object and source-to-film distance.

Tenth Value Layer (TVL) — The thickness of a specified absorbing material which, when introduced into the path of a beam of radiation, reduces the dose rate to one-tenth of its original value.

Threshold Dose — The minimum dose that will produce a detectable degree of any given effect.

Thulium-170 — A radioisotope of the element thulium, having a half life of 127 days.

Timer — A device for controlling the duration of an exposure to ionizing radiation. It is usually capable of being preset.

Tolerance Dose — For industrial safety guidelines, 100 mr/week. (The word 'tolerance' should not be understood to have the meaning allowable, for example, tolerance on machined parts.)

Tracer — An element or compound that has been made radio-active, so that it can be easily followed (traced) in biological and industrial process. Radiation emitted by the radioisotope pinpoints its location.

Transformation Constant — Same as 'Decay Constant'

Transmission — The process of transmitting electric energy in a conductor.

Transparent — Permeable to visible light.

Transport Index — A number expressing the maximum radiation level at 1 meter from the surface of the package measured in mrem/h (1 mrem = 0·01 msv).

Transverse — Literally 'across' usually signifying a direction or plane perpendicular to the longitudinal direction.

Tube Diaphragm — A device normally fixed to a tube shield or head to limit the divergence of the emergent X-ray beam.

Tube Head — A type of tube shield which in addition to the X-ray tube may contain part of the high voltage generator.

Tube Rating — The maximum electrical load can be safely applied to an X-ray tube for a specified period.

Tube Shield — The shockproof housing of an X-ray tube.

Tube Stand — A support often in the form of one or more vertical pillars with adjustable attachments for holding an X-ray tube in position.

Tungsten Alloy — A protective material containing tungsten, copper and nickel, and having density about 50 percent higher than of lead.

Turoidity — Unsharpness due to radiation scattered by a photographic emulsion.

Two-Film Technique — A procedure wherein two films of different relative speeds are used simultaneously to radiograph both the thick and the thin section of an item.

Umbra — A region behind an object in a beam of radiation such that a straight line drawn from any point in this region to any point in the source passes through the object. The umbra is sometimes referred to as the region of total shadow.

Undercut — Excessive radiation intensity which may be found at the edge of an object normally associated with scattered radiation. It also means a specified type of defect occurring in welding.

Under-Development — Development which is less than that required to produce the optimum results in a particular radiograph. It may arise from development for too short a time or at too low a temperature or from the use of exhausted developer.

Unrestricted Area — Any area entry into which is not controlled by the licences and any area used for residential quarters.

Useful Beam — That part of the primary and secondary radiation which passes through the aperature cone or other device for collimation.

Useful Density Range — The range of density over which the gradient is adequate for the recognition of image details. The upper density limit is determined mainly by the brightness available in the film illuminator, and the lower density limit by the sensitivity required.

Vande Graff Generator — An electrostatic type of X-ray generator in the million and multi-million volt category.

Void — Discontinuities in which there is a physical separation between opposite walls.

Volt — The unit of electromotive force which tends to cause an electric current to flow through a conductor.

Wetting Agent — A substance that will reduce the surface tension of a liquid or solid.

White Radiation — Radiation of a particular type having a variety of wavelengths or quantum energies. In the case of X-rays, it is often referred to as continuous spectrum or white radiation.

Whole Body Irradiation (Whole Body Exposure) — Incidence of ionizing radiation on the entire body of the person.

Wire Penetrameter — A penetrameter incorporating a series of wires graded in diameter and usually of similar material as the specimen under examination.

Work Load — The output of a radiation machine or a radioactive a source integrated over a suitable time and expressed in appropriate units.

Xerography — It is a completely dry photographic process which depends on the formation of an electrostatic (latent) image on an insulated selenium layer and the development of this latent image by a finely divided, electrically charged powder. The latest image is formed by exposure to visible light.

Xero-Radiograph — The latent image of negatively charged fine power formation, obtained by xerography.

Xero-Radiography — It is a special application of xerography in the X-ray field where the exciting radiation employed to produce the latent image is only X-rays.

X-unit (X) — A unit of length. The X-unit is defined by assigning the value 3029·45 X to the spacing of the (200) planes of calcite at 18°C. One X-unit equals $(1{\cdot}00202 \pm 0{\cdot}00003) \times 10^{-11}$ cm.

X-Ray — Penetrating electromagnetic radiation emitted when the inner orbital electrons of an atom are excited and release energy. Thus the radiation is non-nuclear in origin and is generated in practice by bombarding a metallic target with high speed electrons.

X-Ray Film — A film base which is coated (usually on both sides) with an emulsion designed for use with X-rays.

X-Ray Frequency — The number of alternations per second of the Rontgen (A) radiation.

X-ray Paper — White paper coated with emulsion for use with or without an intensifying screen. It is suitable for some purposes as an alternative to X-ray film.

X-Ray Spectrum — The orderly separation of the components of an X-ray beam according to its wavelength, frequencies or quantum energies.

X-Ray Tube — A glass vacuum tube which decalerates the high velocity electrons to produce X-rays. (*see* also Umbra).

X-Ray Wavelengths — The wavelength, of Rontgen (X) radiation.

Zircon Sand — A highly absorptive material used as a blocking or masking medium for drilled holes, slots and irregular geometric parts to reduce or eliminate scattered radiation.

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Doc : No. MTD 21 (3543)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Printwell Printers, Aligarh, India